

SD1003

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WIRELESS ENERGY HARVESTING

Summary

- ⦿ Problem
- ⦿ Requirements
- ⦿ Design
- ⦿ Impedance Matching
- ⦿ Testing
- ⦿ Power requirements
- ⦿ Budget

The Problem

- ⦿ Charging a battery without being hooked into the grid.

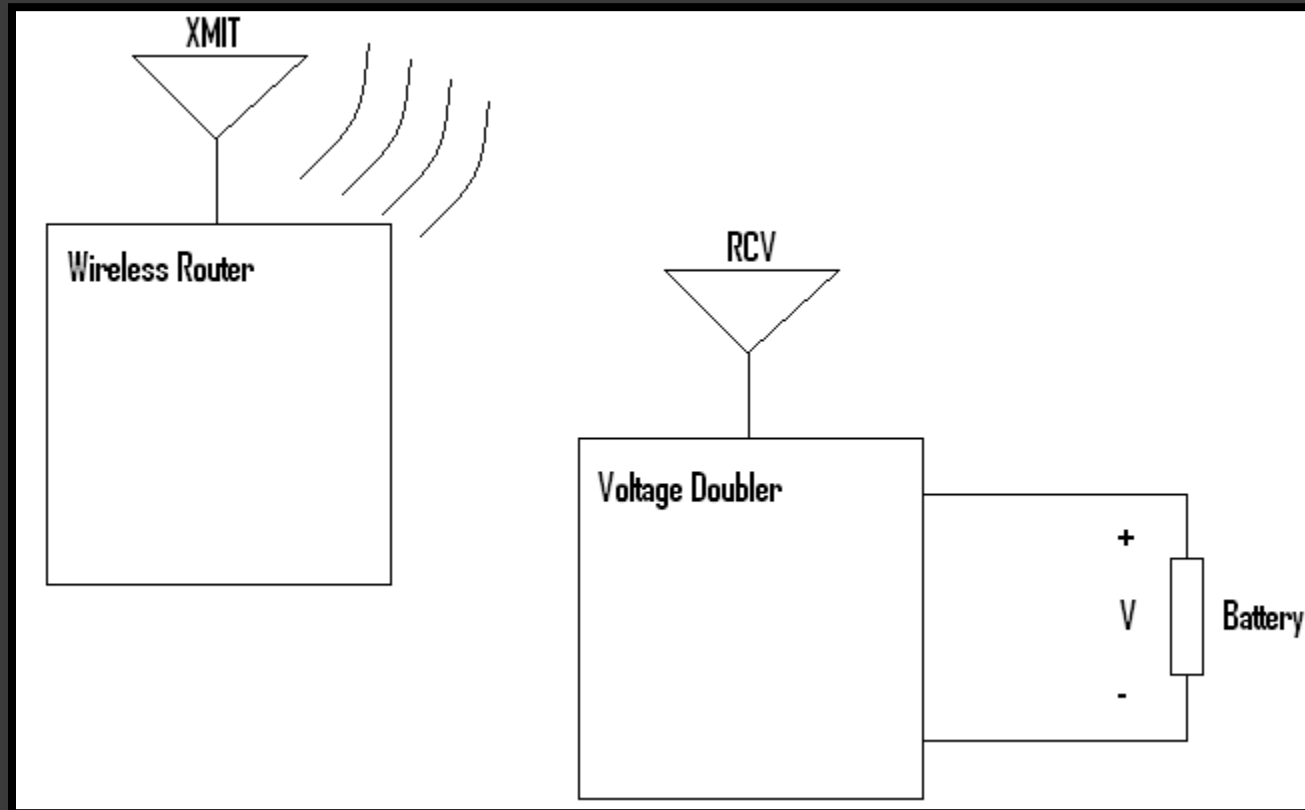
Why Wireless?

- ⦿ Environmental Considerations
- ⦿ Mobility
- ⦿ Energy Costs

Requirements

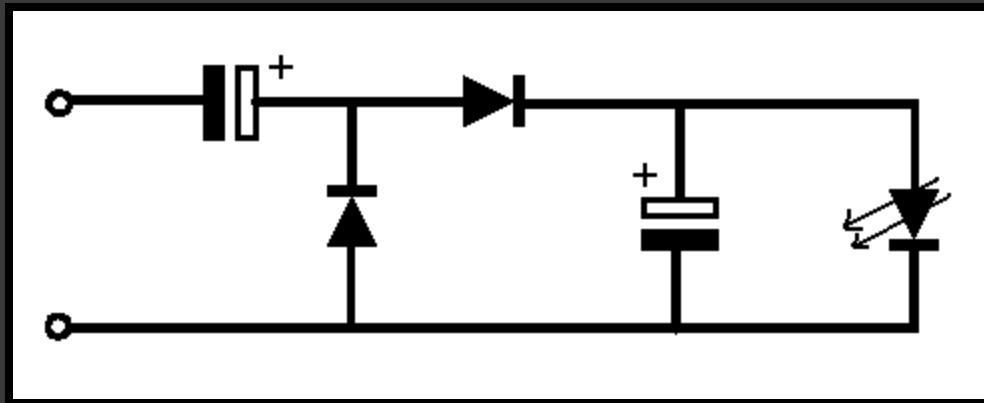
- ⦿ Produce an energy harvesting device centered at 2.45 GHz
- ⦿ Test different loads to verify load dependency
- ⦿ Verify operation at different ranges from transmit antenna

Block Diagram

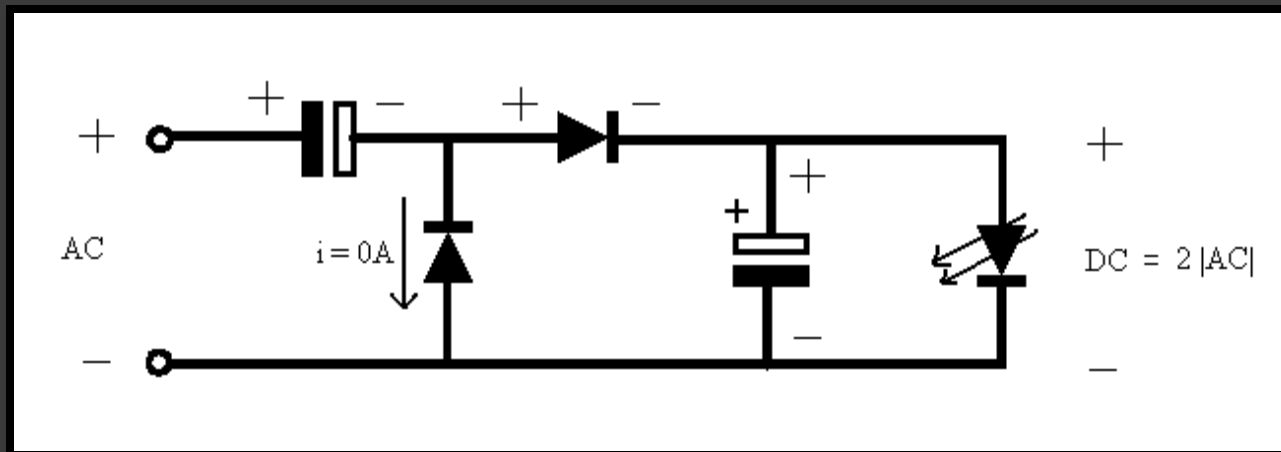
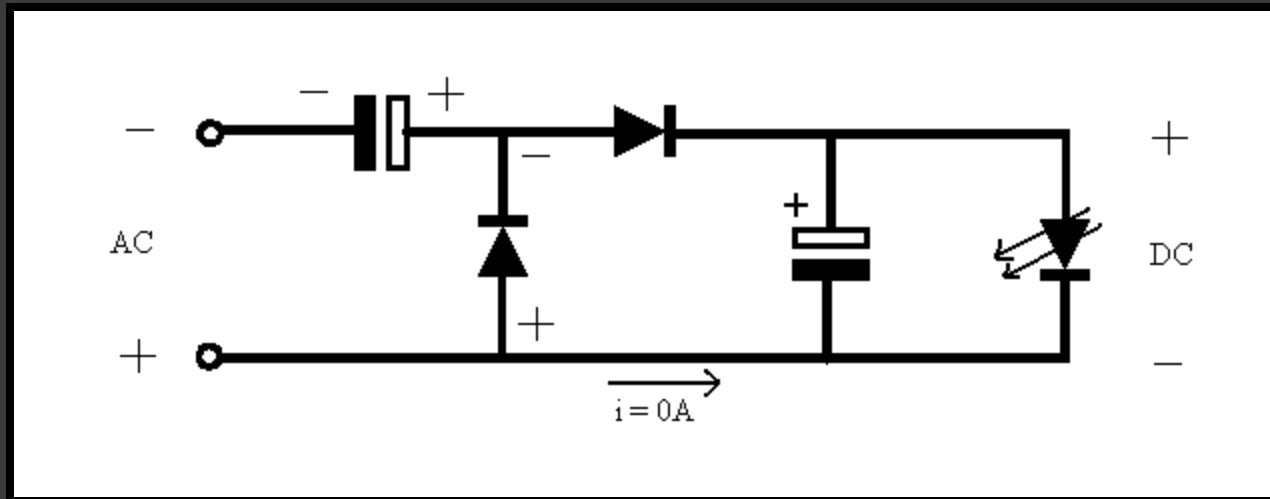


Voltage Doubler

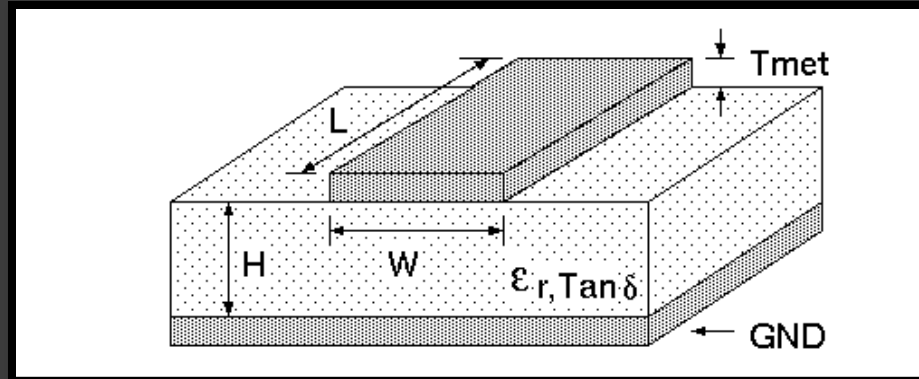
- Uses configuration capacitors and Diodes
- Rectifies AC input to DC output



Voltage Doubler Workings



Lommen's Microstrip Calculator



- ⦿ Allows all active components to be mounted on the top side of the board
- ⦿ Susceptible to cross-talk and unintentional radiation
- ⦿ Calculates W or Z_0 given H and ϵ_r
- ⦿ Important to match the characteristic impedance of microstrip line to that of the source.
 - Maximum power is delivered
 - Improves signal-to-noise ratio
 - Reduces amplitude and phase errors

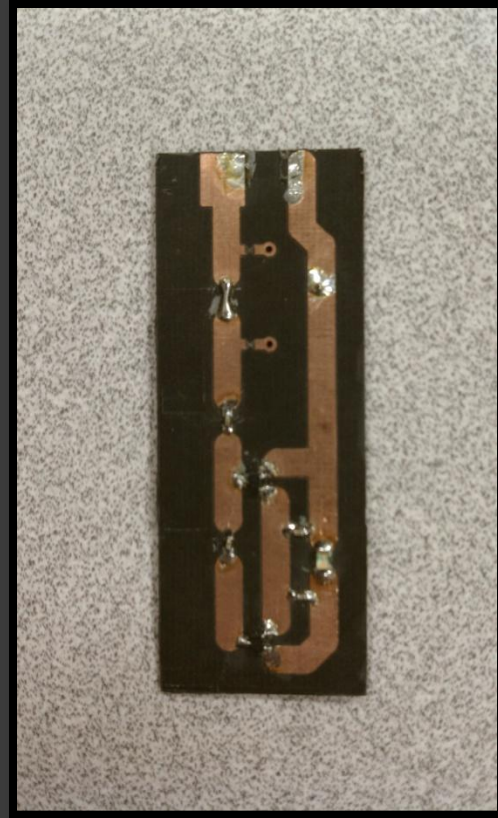
Group Divides



- Brossart and Sandbakken to design a 700 MHz board
- Lommen and Pickett to continue working on the 2.45 GHz design

700 MHz Design (Attempt 1)

- Eventually dubbed “the Fail Board”



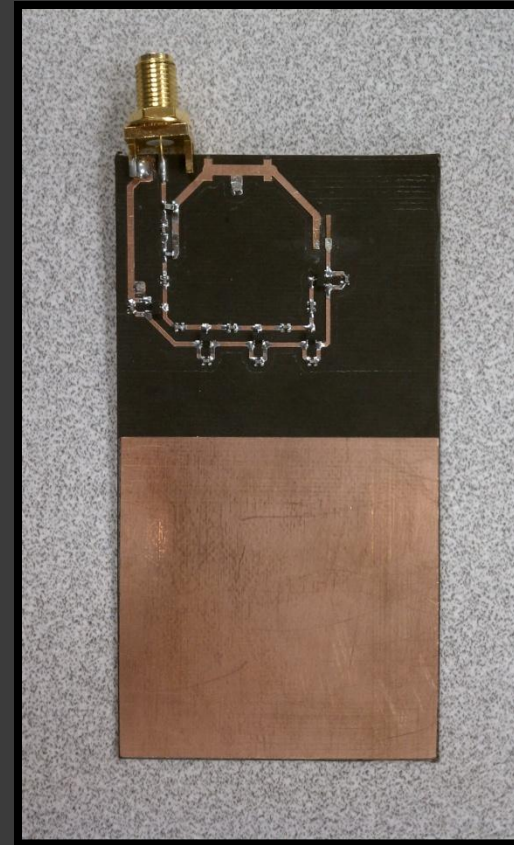
700 MHz Design (Attempt 2)



- ⦿ Designed for 700 MHz
- ⦿ Strong resonance at 2.45 GHz
- ⦿ No load test ☹️

2.45 GHz Design

- Five voltage doublers
- Unreliability issues



Dual 2.45 GHz Prototype

